Fuel Guidance - FT4 Fuel Compatibility

By Tom Gahs

Past CG fuel policy prohibited routine use of any fuels other than F-76 or JP-5 in FT4 gas turbine powered cutters. This was based on Pratt & Whitney concerns with burning Navy Purchase Description Marine Gas Oil (NPD MGO) fuel. It has recently been determined that the FT4 gas turbines are fully compatible with NPD MGO fuel. The latest update to the Naval Engineering Manual (NEM) will relax the restrictions on burning NPD MGO fuel. This article summarizes the rationale for this policy change.

CONCERNS ON USING NPD MGO:

- Lack of NPD trace metal limits - a hot section corrosion concern. Increased rates of hot section corrosion could lead to catastrophic engine failure. The primary metal of concern was vanadium, but other trace metals could have a secondary impact on hot section corrosion rates.
- Higher allowable NPD carbon residue levels - hot section corrosion, burner distress, and fuel nozzle coking concerns. Concerns with burner distress and nozzle coking were secondary because burner and nozzle problems could not lead to catastrophic engine failure.
- Higher allowable NPD ash content - a hot section corrosion concern.
- Higher allowable NPD maximum viscosity - a burner distress and streaking concern.
- Loss of MIL-SPEC QA procedures - might increase likelihood of contamination from residual fuel products. The very nature of distillate fuel production produces characteristically low trace metal and ash levels, but contamination with residual fuel during storage or transport could introduce extremely high levels of trace metals, ash, and carbon residue.
- The lack of NPD storage stability requirements was a concern for all CG platforms, regardless of whether they were powered by diesels or gas turbines.

The CG's NPD MGO/FT4 compatibility investigations relied on a parallel path approach: 1) an in-line fuel quality sampling program on CG vessels; 2) laboratory hot section corrosion evaluations.

INLINE FUEL SAMPLING PROGRAM RESULTS. All FT4 specific concerns turned out to be non-issues because of the NPD MGO fuel's overall high quality. Fuel parameters of concern rarely, if ever, exceeded F-76 standards (worst case was 4% of the samples exceeded the F-76 trace metal limits for calcium and sodium + potassium). The results also established that standard commercial fuel handling practices were adequate to protect our cutters from residual fuel contamination. The only concern identified was storage stability, but again, this is a concern for all Coast Guard platforms, regardless of their propulsion plant type.

LABORATORY MATERIAL INVESTIGATIONS. Hot section corrosion evaluations were conducted by the Carderock Division, Naval Surface Warfare Center and were closely coordinated with Pratt & Whitney. It was found that the NPD's maximum allowed carbon residue levels doubled hot section corrosion rates. However, the fuel's measured carbon residue levels, as delivered to the cutters, rarely exceeded the maximum level allowed by the F-76 spec. Based largely on these two findings, the Navy is reducing the NPD maximum allowable carbon residue level to equal that of the F-76 specification. The carbon residue hot corrosion concerns will be controlled through demonstrated high fuel quality.

PRACTICAL EXPERIENCE. As the Navy infrastructure has shrunk, it has become more difficult for CG cutters to load MIL-SPEC fuel. Typically, the only fuel in a non-Navy port will be NPD MGO (or worse, an open market marine distillate). Operational realities have forced many 378's to take on NPD MGO despite its past status (on FT4 powered cutters) as an emergency substitute fuel. DESC bunker fuel databases show that 378 WHECs have burned 4.3 million gallons of NPD MGO since 1997. No marked increase in FT4 casualties or maintenance has been observed.

UPDATED POLICY.

- The restriction on burning NPD MGO fuel on FT4 gas turbine powered cutters is no longer in effect. All cutters shall select the least expensive of F-76, F-44 (JP-5), or NPD MGO fuel.
- The following conditions apply to FT4 gas turbine powered cutters when burning NPD MGO fuel:
  - The NPD MGO fuel must be obtained from a DESC bunker contractor. See http://www.desc.dla.mil/main/p/specialt/bunkers/bltngate.htm for a list of DESC contractors.
  - MGO fuel not obtained from a DESC Contractor (open market) shall be treated as an emergency substitute fuel (see the NEM for emergency substitute fuel requirements). Only 100% distillate emergency substitute MGO fuels shall be burned in FT4 gas turbines.
  - Participation in the CG's in-line fuel quality sampling program is highly recommended. The

sampling program analyzes the quality of all commercial fuel products. If there should be a quality concern , problem specific advice will be passed to the cutter to minimize any potential risk to the FT4 gas turbines.

If you should have a shipboard fuel quality questions, contact Tom Gahs at ELC-026, voice 410-762-6291, email TGahs@elcbalt.uscg.mil. A CG fuel quality web site has also been set up. The site includes the CG's fuel quality database from our Inline Fuel Sampling Program, valuable links, and past ELC LOG Fuel Guidance articles. The address is http://cgweb.elcbalt.uscg.mil/docs/Fueltest/fueltest.htm.